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T-140-1-Krynski, S. and Becla, E. - Infection of lice with *Pasteurella pseudotuberculosis*. *Societe Francaise de Microbiologie* 104(1): 133-36, 1963.

Infection of lice with *Pasteurella pseudotuberculosis*. By S. Krynski and E. Becla (Microbiology Chair, 1 Hibner Street, Gdansk, Poland).

The role of lice in the transmission of rickettioses and borrelioses has been known for a long time, but it is still disputed in the other epidemic ailments, especially in the plague.

The intestine of lice is normally sterile. The bacteria which penetrate with infected human blood, or which are inoculated anally according to the Weigl method, rapidly multiply there. Partially digested blood is a very favorable medium for bacteria. Micrococci and staphylococci produce veritable epizooties among culture lice (2,4,7,8). They rapidly multiply in the insects' intestines, but never bring about the death of those insects. On the contrary, enterobacteria cause among lice a malady which kills them at the end of forty-eight hours. (1,3,5,6,9).

No study regarding the infection of lice with *Pasteurella* having been made up to now, it has appeared to us to be most interesting to inoculate those insects anally with a suspension of *P. pseudotuberculosis* to see whether the evolution of *Pasteurella*-caused ailment were as rapidly mortal for them as the ailment caused by *S. typhi* (1,6), *Sh. dysenteriae* (1,6), *E. coli* (1,3) and *P. vulgaris* (3,5). If there were no difference, the possibility of transmission of the *P. pseudotuberculosis* infection by lice would not exist, or else would be dubious. On the contrary, if the evolution were slow and lengthy, that possibility would exist.

In the present study, which is only a preliminary work, we have taken into consideration the growth of *P. pseudotuberculosis* in the lice intestine and the mortality of the infected insects.

METHODS

Our experiences concerned 5,250 culture lice. We have used adult insects immediately after the second molting (12 days); those insects were kept in 32° sweating room and fed once a day on human volunteers. The *P. pseudotuberculosis* stocks were provided by Dr H. Mollaret of the Institut Pasteur. We have used germs cultivated on inclined gelose during 18 hours and washed twice in physiological water. The insects were inoculated interrectally according to the Weigl method. Each louse was infected with 10 to 25 germs.

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The infected lice were put in cages and set into warm chambers at a temperature of 32°C . They were fed once a day on human volunteers. Each time we seeded the fecal matter and checked the cages, removing the dead insects. The experiences were discontinued seven to ten days after the inoculation of the germs.

We have made the numeration of live germs in the lice intestine 0, 3, 6, 9, 12, 15, 24, 30, 36 and 48 hours after the inoculation. For each numeration we have used 10 insects, which had been washed once in 75 per 100 (75%) alcohol and twice in physiological water, ground and mixed in emulsion with physiological water.

RESULTS

P. pseudotuberculosis is capable of developing in the lice intestine. We did not notice any difference along the line of serological types. If we examine the curve of growth of *P. pseudotuberculosis* in lice intestine, we can distinguish there the same phases as in a broth culture (fig 1.).

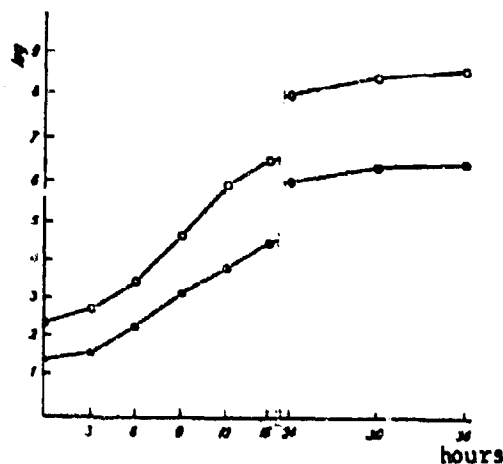


Fig. 1. - Growth of *P. pseudotuberculosis* (type I) in the lice intestine and in broth. -- o, broth; •, lice intestine.

The duration of the latence phase does not surpass three hours. The exponential phase in the lice intestine, or intestine of the louse, is slightly less rapid than in broth. The beginning of the slowing-down phase is observed between the fifteenth and the 24-th hour of the incubation. In most of our experiments the persistence in the intestine and in the fecal elimination of germs were noticed until the death of the infected lice; but it must be underlined that we observed the presence of specimens which, seven to ten days after the inoculation of *P. pseudotuberculosis*, had become sterile.

The virulence of *P. pseudotuberculosis* for lice is in relation to the serological type. Table I and figure 2 show the percentages of dead lice. The highest mortality was observed two and three days after the inoculation of the germs.

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Table I. Percentage of dead after inoculation with *P. pseudotuberculosis*.

Type	1 day	2 days	3 days	4 days	5 days	6 days	7 days
I	2.0	25.2	51.6	60.8	67.6	71.6	72.0
II	1.2	26.8	59.6	72.4	79.6	81.6	82.4
III	1.2	22.8	59.6	77.6	84.4	87.2	88.4
IV	1.6	25.6	52.0	76.0	85.6	88.0	90.4
V	1.6	26.	57.6	79.2	84.8	88.8	91.6

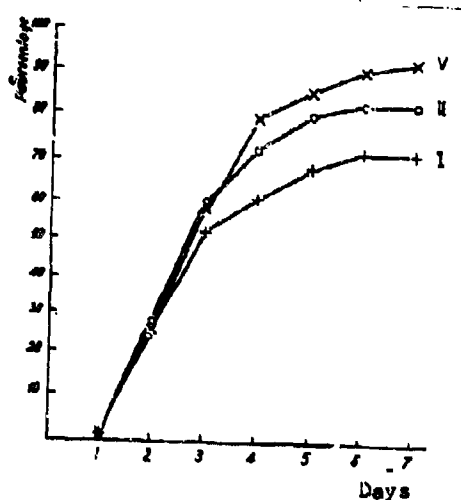
Fig. 2. - Percentage of dead lice after inoculation with *P. pseudotuberculosis* (type I, II, and V).

Table II. - Statistical analysis of results presented on table I.

Types	3 days	4 days	5 days	6 days	7 days
I - II	2.9	7.0	8.6	6.4	7.0
I-III	2.9	15.8	18.4	17.6	20.0
I-IV	-	13.0	21.6	20.0	26.5
I - V	1.6	19.3	19.6	22.05	31.1
II-III	-	1.5	1.6	2.5	3.2
II-IV	2.6	1.5	2.6	3.5	6.14
II - V	2.6	2.8	1.97	4.6	8.7

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The statistical analysis of the results which were obtained, shown on table II, allows us to note that during the first three days of the inoculation no significant differences according to serological types were noted. From the fourth day of the infection those differences are clear between type I and the other types; from the sixth day on, between types II and V, and since the seventh day between types II and IV.

CONCLUSIONS.

P. pseudotuberculosis develops perfectly in the intestine of the louse (lice intestines). There is a correlation between its virulence and the serological type. Types III, IV, and V provide the highest mortality. The virulence of type II is more moderate. Type I is the least virulent.

The louse probably plays no part in the epidemiology of infections with *P. pseudotuberculosis*; but the studies which we made make it possible to suppose that there is a possibility of development of *P. pseudotuberculosis* among the arthropods and present the problem of an eventual transmission of the ailment by them.

SUMMARY

~~Infection of lice with *Pasteurella pseudotuberculosis*.~~

P. pseudotuberculosis very rapidly multiplies in lice intestine. There is a relationship between virulence and serological type. Types III, IV, V induce the highest mortality. The type II virulence is lower. Type I is the less virulent for lice.

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